CLAIMS

1. An integrated microreactor, comprising:

a monolithic body, having a semiconductor material region;

a buried channel, extending inside said semiconductor material region;

a first and a second access cavity, extending in said monolithic body, and in communication with said buried channel;

a suspended diaphragm formed from said monolithic body, laterally to said buried channel; and

a detection electrode , supported by said suspended diaphragm.

2. A microreactor according to claim 1, wherein said monolithic body comprises an insulating region, superimposed to said semiconductor material region, and forming said suspended diaphragm.

3. A microreactor according to claim 2, having a heating element, extending over said semiconductor material region, on top of said buried channel.

4. A microreactor according to claim 3, wherein said heating element is embedded in said insulating region.

5. A microreactor according to claim 2, wherein said detection electrode extends on top of said insulating region.

6. A microreactor according to claim 1, wherein said semiconductor material region comprises a monocrystalline substrate and an epitaxial layer, superimposed on one another.

7. A microreactor according to claim 6, wherein said semiconductor material region has a cavity extending beneath said diaphragm, as far as said insulating region.

8. A microreactor according to claim 2, wherein said monolithic body comprises a reservoir region, extending on top of said insulating region, and defines a first and a second reservoir, connected respectively to a first and a second trench, said first and a second trench extending through said insulating region and said semiconductor material region, as far as said buried channel, said second reservoir accommodating said detection electrode.

9. A microreactor according to claim 1, wherein said semiconductor material region comprises a monocrystalline substrate, with a <110> crystallographic orientation, and in that said buried channel has a longitudinal direction that is substantially parallel to a crystallographic plane with a <111> orientation.

10. A microreactor according to claim 1, wherein said buried channel has a depth of up to 600-700 μm.

11. A method for manufacturing a microreactor, comprising:

forming a monolithic body, said step of forming a monolithic body including forming a semiconductor material region;

forming a buried channel in said semiconductor material region;

forming a first and a second access cavity, said first and a second access cavity extending in said monolithic body as far as said buried channel;

forming a suspended diaphragm laterally to said buried channel; and

forming a detection electrode on top of said suspended diaphragm.

12. A method according to claim 11, wherein said step of forming a monolithic body comprises the step of forming an insulating region on top of said region of semiconductor material, before said step of forming a detection electrode.

13. A method according to claim 12, further comprising the step of forming a heating electrode in said insulating region, over said buried channel.

14. A method according to claim 11, wherein said step of forming a semiconductor material region comprises the steps of forming a monocrystalline substrate; forming said buried channel in said monocrystalline substrate; and growing an epitaxial layer on top of said monocrystalline substrate and said buried channel.

15. A method according to claim 12, wherein said step of forming said suspended diaphragm comprises the step of selectively removing part of said semiconductor material region, as far as said insulating region.

16. A method according to claim 16, wherein said step of removing comprises etching said semiconductor material region using TMAH.

17. A method according to claim 14, wherein said step of forming a monocrystalline substrate comprises growing semiconductor material with <110> orientation, and in that said step of forming a buried channel comprises etching said monocrystalline substrate along a parallel direction to an <111> orientation plane.

18. A method according to claim 17, wherein, during said step of etching said monocrystalline substrate, a grid-shaped mask is used with polygonal apertures, with sides extending at approximately 45° with respect to said <111> orientation plane.

19. A method according to claim 17, wherein said monocrystalline substrate is etched using TMAH.

20. A method according to claim 14, wherein said step of forming a buried channel comprises masking said substrate through a grid-like hard mask, and etching said substrate through the hard mask.

21. A method according to claim 20, wherein said hard mask comprises a polycrystalline region, surrounded by a covering layer of dielectric material, and in that, after said step of etching said substrate, said covering layer is removed, and said epitaxial layer is grown on said polycrystalline region, thereby forming a polycrystalline layer, and on said substrate, thereby forming a monocrystalline region.

22. A method according to claim 20, wherein said hard mask comprises a dielectric material grid, and in that said epitaxial layer grows on said substrate and on said dielectric material grid, forming a monocrystalline region on said substrate, and a polycrystalline region on said dielectric material grid.

23. A structure comprising:

a semiconductor material body;

a buried channel formed in the semiconductor material body at a distance from a surface of the semiconductor material body.

first and second trenches, formed on the semiconductor material body, extending from a top surface of the semiconductor material body to first and second ends, respectively, of the buried channel;

a heating element, formed on the semiconductor material body above the buried channel;

a suspended diaphragm, formed on the semiconductor material body and adjacent to the buried channel; and

a sensing electrode structure, formed on the semiconductor material body above the suspended diaphragm.

24. The structure of claim 23, further comprising first and second reservoirs, formed on the surface of the semiconductor material body, wherein the first reservoir is above the first trench such that the first trench connects the first reservoir with the first end of the buried channel, and the second reservoir is above the second trench such that the second trench connects the second reservoir with the second end of the buried channel, and such that the second reservoir extends onto the suspended diaphragm, with the sensing electrode structure inside the second reservoir.

25. The structure of claim 24 wherein the first and second reservoirs are formed in, and defined by a resist layer formed on the surface of the semiconductor material body.

26. A method, comprising:

introducing a fluid into a buried channel, the buried channel extending in a semiconductor material body at a distance from a surface of the semiconductor material body;

heating the fluid within the buried channel;

cooling the fluid within the buried channel.

extracting the fluid from the buried channel into a reservoir, the reservoir being integrated in the semiconductor body; and

detecting a desired product within the fluid, wherein the detection step is performed by the use of a sensing electrode structure, the sensing electrode structure being integrated in the semiconductor material body above a suspended diaphragm, and in contact with the fluid.

27. The method of claim 26 wherein the heating step is performed by:

passing an electric current through a heating element arranged in the semiconductor material body on top of the buried channel.

28. The method of claim 26 wherein:

the step of introducing is performed via a first access trench formed in the semiconductor material body, the fluid being introduced from a first reservoir formed on the surface of the semiconductor material body, through the first access trench and into the buried channel;

the step of extracting is performed via a second access trench formed in the semiconductor material body, the fluid being extracted from the buried channel, through the second access trench and into a second reservoir formed on the surface of the semiconductor material body; and

the sensing electrode structure is formed within the second reservoir.

29. The method of claim 28 wherein the first and second reservoirs are formed in, and defined by a resist layer formed on the surface of the semiconductor material body.

30. The method according to claim 26 further including repeating the heating and cooling steps a plurality of times to achieve a desired reaction in biological matter within the fluid.

31. The method according to claim 26, wherein the cooling step is carried out by:

terminating the heating of the fluid; and

permitting the fluid to cool towards the ambient.

32. The method according to claim 26, wherein the cooling step is carried out by:

terminating the heating of the fluid; and

drawing heat from the fluid using a heat transfer mechanism.

33. The method of claim 26, wherein the suspended diaphragm is formed by an insulation layer formed on the semiconductor material body, and wherein the sensing electrode structure is formed on the insulation layer.